

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**

# Refine Search

## Search Results -

Terms	Documents
L21 and L20 and L18 and L17	2

Database:

US Pre-Grant Publication Full-Text Database  
US Patents Full-Text Database  
US OCR Full-Text Database  
EPO Abstracts Database  
JPO Abstracts Database  
Derwent World Patents Index  
IBM Technical Disclosure Bulletins

Search:

L22

Refine Search

Recall Text

Clear

Interrupt

## Search History

DATE: Saturday, September 04, 2004 [Printable Copy](#) [Create Case](#)

### Set Name Query

side by side

### Hit Count Set Name

result set

DB=USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ

<u>L22</u>	L21 and L20 and L18 and L17	2	<u>L22</u>
<u>L21</u>	L19 with L14	291	<u>L21</u>
<u>L20</u>	L19 with L16	153	<u>L20</u>
<u>L19</u>	clock adj3 buffer	1617	<u>L19</u>
<u>L18</u>	L14 near6 (chang\$3 or state or differen\$4 or modifi\$6 or alter\$6)	97923	<u>L18</u>
<u>L17</u>	L16 with L15 with L14	85	<u>L17</u>
<u>L16</u>	internal near4 (clock or pulse)	7889	<u>L16</u>
<u>L15</u>	input near4 (buffer or register)	53737	<u>L15</u>
<u>L14</u>	(input or receiv\$3) near4 signal	794816	<u>L14</u>

DB=PGPB,USPT; PLUR=YES; OP=ADJ

<u>L13</u>	L12 and (data near4 buffer)	76	<u>L13</u>
<u>L12</u>	L11 and (address near4 buffer)	82	<u>L12</u>
<u>L11</u>	L10 and (command near4 buffer)	84	<u>L11</u>
<u>L10</u>	L9 and L4	228	<u>L10</u>
<u>L9</u>	L8 and L7 and L6	397	<u>L9</u>
<u>L8</u>	L5 with L3	1118	<u>L8</u>
<u>L7</u>	L5 with L1	1926	<u>L7</u>
<u>L6</u>	L1 near6 (chang\$3 or state or differen\$4 or modifi\$6 or alter\$6)	168198	<u>L6</u>

<u>L5</u>	clock adj3 buffer	6991	<u>L5</u>
<u>L4</u>	L3 with l2 with l1	703	<u>L4</u>
<u>L3</u>	internal near4 (clock or pulse)	26659	<u>L3</u>
<u>L2</u>	input near4 (buffer or register)	103583	<u>L2</u>
<u>L1</u>	(input or receiv\$3) near4 signal	689122	<u>L1</u>

END OF SEARCH HISTORY

# Refine Search

## Search Results -

Terms	Documents
L12 and L10 and L9	1

Database:

US Pre-Grant Publication Full-Text Database  
US Patents Full-Text Database  
US OCR Full-Text Database  
EPO Abstracts Database  
JPO Abstracts Database  
Derwent World Patents Index  
IBM Technical Disclosure Bulletins

Search:

L13

Refine Search

Recall Text

Clear

Interrupt

## Search History

DATE: Friday, September 03, 2004 [Printable Copy](#) [Create Case](#)

**Set Name Query**  
side by side

**Hit Count Set Name**  
result set

DB=USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ

<u>L13</u>	L12 and L10 and L9	1	<u>L13</u>
<u>L12</u>	L11 with ((input adj2 signal) near6 (chang\$4 or alter\$6 or modifi\$8 or state))	26	<u>L12</u>
<u>L11</u>	(input adj2 signal) with (internal near4 (clock or pulse))	326	<u>L11</u>
<u>L10</u>	((input or read or I/O) near4 (buffer or register)) with (internal near4 clock)	191	<u>L10</u>
<u>L9</u>	L8 near8 (internal near3 clock)	1834	<u>L9</u>
<u>L8</u>	clock near4 (buffer or register or generat\$4)	70503	<u>L8</u>

DB=USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=ADJ

<u>L7</u>	clock near4 (buffer or register or generat\$4)	161166	<u>L7</u>
-----------	--	--------	-----------

DB=PGPB,USPT; PLUR=YES; OP=ADJ

<u>L6</u>	L5 and L3 and L2	26	<u>L6</u>
<u>L5</u>	L4 with ((input adj2 signal) near6 (chang\$4 or alter\$6 or modifi\$8 or state))	90	<u>L5</u>
<u>L4</u>	(input adj2 signal) with (internal near4 (clock or pulse))	1375	<u>L4</u>
<u>L3</u>	((input or read or I/O) near4 (buffer or register)) with (internal near4 clock)	1427	<u>L3</u>
<u>L2</u>	L1 near8 (internal near3 clock)	6381	<u>L2</u>
<u>L1</u>	clock near4 (buffer or register or generat\$4)	107853	<u>L1</u>

END OF SEARCH HISTORY

## Welcome to IEEE Xplore<sup>®</sup>

- ☐ Home
- ☐ What Can I Access?
- ☐ Log-out

## Tables of Contents

- ☐ Journals & Magazines
- ☐ Conference Proceedings
- ☐ Standards

## Search

- ☐ By Author
- ☐ Basic
- ☐ Advanced

## Member Services

- ☐ Join IEEE
- ☐ Establish IEEE Web Account
- ☐ Access the IEEE Member Digital Library

## IEEE Enterprise

- ☐ Access the IEEE Enterprise File Cabinet

## Print Format

[Home](#) | [Log-out](#) | [Journals](#) | [Conference Proceedings](#) | [Standards](#) | [Search by Author](#) | [Basic Search](#) | [Advanced Search](#) | [Join IEEE](#) | [Web Account](#) | [New this week](#)  
[OPAC Linking Information](#) | [Your Feedback](#) | [Technical Support](#) | [Email Alerting](#) | [No Robots Please](#) | [Release Notes](#) | [IEEE Online Publications](#) | [Help](#) | [FAQ](#) | [Terms](#)  
[Back to Top](#)

Copyright © 2004 IEEE — All rights reserved

Your search matched **0** of **1067317** documents.

A maximum of **500** results are displayed, **15** to a page, sorted by **Relevance** in **Descending** order.

### Refine This Search:

You may refine your search by editing the current search expression or entering a new one in the text box.

☐ Check to search within this result set

### Results Key:

**JNL** = Journal or Magazine   **CNF** = Conference   **STD** = Standard

### Results:

No documents matched your query.

### Welcome to IEEE Xplore®

- ☐ Home
- ☐ What Can I Access?
- ☐ Log-out

### Tables of Contents

- ☐ Journals & Magazines
- ☐ Conference Proceedings
- ☐ Standards

### Search

- ☐ By Author
- ☐ Basic
- ☐ Advanced

### Member Services

- ☐ Join IEEE
- ☐ Establish IEEE Web Account
- ☐ Access the IEEE Member Digital Library

### IEEE Enterprise

- ☐ Access the IEEE Enterprise File Cabinet

### Print Format

Your search matched **0** of **1067317** documents.

A maximum of **500** results are displayed, **15** to a page, sorted by **Relevance** in **Descending** order.

### Refine This Search:

You may refine your search by editing the current search expression or entering a new one in the text box.

☐ Check to search within this result set

### Results Key:

**JNL** = Journal or Magazine   **CNF** = Conference   **STD** = Standard

### Results:

**No documents matched your query.**

IEEE Xplore®  
RELEASE 1.8Welcome  
United States Patent and Trademark Office

» Advanced Search

[Help](#) [FAQ](#) [Terms](#) [IEEE Peer Review](#)[Quick Links](#)

Welcome to IEEE Xplore®

- ☐ Home
- ☐ What Can I Access?
- ☐ Log-out

Tables of Contents

- ☐ Journals & Magazines
- ☐ Conference Proceedings
- ☐ Standards

Search

- ☐ By Author
- ☐ Basic
- ☐ Advanced

Member Services

- ☐ Join IEEE
- ☐ Establish IEEE Web Account
- ☐ Access the IEEE Member Digital Library

IEEE Enterprise

- ☐ Access the IEEE Enterprise File Cabinet

Try our New Full-text Search Prototype **GO**[Help](#)

- 1) Enter a single keyword, phrase, or Boolean expression.  
Example: acoustic imaging (means the phrase acoustic imaging plus any stem variations)
- 2) Limit your search by using search operators and field codes, if desired.  
Example: optical <and> (fiber <or> fibre) <in> ti
- 3) Limit the results by selecting Search Options.
- 4) Click Search. See [Search Examples](#)

```
((input signal) <near/4>
chang$) <sentence> clock
buffer <paragraph> (generat$
<near/4> (internal clock))
```

Start Search

Clear

Note: This function returns plural and suffixed forms of the keyword(s).

Search operators: <and> <or> <not> <in> [More](#)

Field codes: au (author), ti (title), ab (abstract), jn (publication name), de (index term) [More](#)

## Search Options:

## Select publication types:

- ☒ IEEE Journals
- ☒ IEE Journals
- ☒ IEEE Conference proceedings
- ☒ IEE Conference proceedings
- ☒ IEEE Standards

## Select years to search:

From year:  to 


## Organize search results by:

Sort by: In:  orderList  Results per page




Terms used

Found 12,183 of 141,680

Sort results by 
 Save results to a Binder

Try an Advanced Search

Display results 
 Search Tips

Try this search in [The ACM Guide](#)
☐ Open results in a new window

Results 1 - 20 of 200

Result page: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [next](#)


Best 200 shown

Relevance scale ☐ ☐ ☐ ☐ ☐

# 1 [An Unclever Time-Sharing System](#)

Caxton C. Foster

January 1971 **ACM Computing Surveys (CSUR)**, Volume 3 Issue 1

Full text available:  pdf(1.85 MB)


Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper describes the internal structure of a time-sharing system in some detail. This system is dedicated to providing remote access, and has a simple file structure. It is intended for use in a university type environment where there are many short jobs that will profit from one- or two-second turnaround. Despite its simplicity, this system can serve as a useful introduction to the problems encountered by the designers of any time-sharing system. Included are a discussion of the common ...

# 2 [Interactive Editing Systems: Part II](#)

Norman Meyrowitz, Andries van Dam

September 1982 **ACM Computing Surveys (CSUR)**, Volume 14 Issue 3


Full text available:  pdf(9.17 MB)

Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

# 3 [Fast detection of communication patterns in distributed executions](#)

Thomas Kunz, Michiel F. H. Seuren

November 1997 **Proceedings of the 1997 conference of the Centre for Advanced Studies on Collaborative research**

Full text available:  pdf(4.21 MB)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Understanding distributed applications is a tedious and difficult task. Visualizations based on process-time diagrams are often used to obtain a better understanding of the execution of the application. The visualization tool we use is Poet, an event tracer developed at the University of Waterloo. However, these diagrams are often very complex and do not provide the user with the desired overview of the application. In our experience, such tools display repeated occurrences of non-trivial commun ...

# 4 [Contention resolution with constant expected delay](#)

Leslie Ann Goldberg, Philip D. Mackenzie, Mike Paterson, Aravind Srinivasan

November 2000 **Journal of the ACM (JACM)**, Volume 47 Issue 6

Full text available:  pdf(388.69 KB)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

We study contention resolution in a multiple-access channel such as the Ethernet channel. In the model that we consider,  $n$  users generate messages for the channel according to a probability distribution. Raghavan and Upfal have given a protocol in which the expected delay (time to get serviced) of every message is  $O(\log n)$  when messages are generated




according to a Bernoulli distribution with generation rate up to about 1/10. Our main result ...

**Keywords:** Markov chains, contention resolution, ethernet, multiple-access channel

5 Abstract interaction tools: a language for user interface management systems

Jan Van Den Bos

April 1988 **ACM Transactions on Programming Languages and Systems (TOPLAS)**,  
Volume 10 Issue 2

Full text available:  [pdf\(2.45 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

A language model is presented for the specification of User Interface Management Systems. The model, called the Abstract Interaction Tool (AIT) model, offers a tree-like hierarchy of interaction objects. Each object represents a subtree and can be considered as an abstract input device containing a syntax-like specification of the required input pattern. The hierarchy of specifications amounts to a system of syntactical productions with multiple control. Terminal nodes of the AIT tree represent ...

6 Basic elements of COBOL 61

Jean E. Sammet

May 1962 **Communications of the ACM**, Volume 5 Issue 5

Full text available:  [pdf\(1.70 MB\)](#)

Additional Information: [full citation](#), [references](#), [citations](#)

7 SpeechSkimmer: a system for interactively skimming recorded speech

Barry Arons

March 1997 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 4 Issue 1

Full text available:  [pdf\(1.03 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

Listening to a speech recording is much more difficult than visually scanning a document because of the transient and temporal nature of audio. Audio recordings capture the richness of speech, yet it is difficult to directly browse the stored information. This article describes techniques for structuring, filtering, and presenting recorded speech, allowing a user to navigate and interactively find information in the audio domain. This article describes the SpeechSkimmer system for interactive ...

**Keywords:** audio browsing, interactive listening, nonspeech audio, speech as data, speech skimming, speech user interfaces, time compression

8 The early history of COBOL

Jean E. Sammet

January 1978 **ACM SIGPLAN Notices , The first ACM SIGPLAN conference on History of programming languages**, Volume 13 Issue 8

Full text available:  [pdf\(3.10 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper discusses the early history of COBOL, starting with the May 1959 meeting in the Pentagon which established the Short Range Committee which defined the initial version of COBOL, and continuing through the creation of COBOL 61. The paper gives a detailed description of the committee activities leading to the publication of the first official version, namely COBOL 60. The major inputs to COBOL are discussed, and there is also a description of how and why some of the technical decisions ...

9 Development and application of NASA's first standard spacecraft computer

Charles E. Trevathan, Thomas D. Taylor, Raymond G. Hartenstein, Ann C. Merwarth, William N. Stewart

September 1984 **Communications of the ACM**, Volume 27 Issue 9

To provide the autonomy needed by low, earth-orbiting satellites, NASA's first standard on-board processor requires changing only interfacing hardware from mission to mission.

**Keywords:** PASS, avionics system

10 A new string search hardware architecture for VLSI

K. Takahashi, H. Yamada, H. Nagai, K. Matsumi

June 1986 **ACM SIGARCH Computer Architecture News , Proceedings of the 13th annual international symposium on Computer architecture**, Volume 14 Issue 2

Full text available:  [pdf\(683.39 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

This paper presents a new architecture for practical string search hardware design. This architecture is based on the finite state automaton design concept using a character control charge transfer model. The resultant hardware is a set of programmable sequential logic (PSL) circuits, each of which consists of a sequential logic and memory parts. The logic part is an array of logical gates, each of which is controlled by the read-out signal from the memory part, to connect the flip-flops. T ...

11 Architectures: A perspective on the future of massively parallel computing: fine-grain vs. coarse-grain parallel models comparison & contrast

Predrag T. Tasic

April 2004 **Proceedings of the first conference on computing frontiers on Computing frontiers**

Full text available:  [pdf\(277.49 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Models, architectures and languages for *parallel computation* have been of utmost research interest in computer science and engineering for several decades. A great variety of parallel computation models has been proposed and studied, and different parallel and distributed architectures designed as some possible ways of harnessing parallelism and improving performance of the general purpose computers. *Massively parallel connectionist models* such as *artificial neural networks* ( ...

**Keywords:** cellular automata, distributed systems, massively parallel computing, multiprocessor computers, neural networks, parallel computation models

12 Abstract state machines capture parallel algorithms

Andreas Blass, Yuri Gurevich

October 2003 **ACM Transactions on Computational Logic (TOCL)**, Volume 4 Issue 4

Full text available:  [pdf\(610.28 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

We give an axiomatic description of parallel, synchronous algorithms. Our main result is that every such algorithm can be simulated, step for step, by an abstract state machine with a background that provides for multisets.

**Keywords:** ASM thesis, Parallel algorithm, abstract state machine, postulates for parallel computation

13 Concurrency, latency, or system overhead: which has the largest impact on uniprocessor DRAM-system performance?

Vinodh Cuppu, Bruce Jacob

May 2001 **ACM SIGARCH Computer Architecture News , Proceedings of the 28th annual international symposium on Computer architecture**, Volume 29 Issue 2

Full text available:  [pdf\(904.17 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

 [Publisher Site](#)

*Given a fixed CPU architecture and a fixed DRAM timing specification, there is still a large*

*design space for a DRAM system organization. Parameters include the number of memory channels, the bandwidth of each channel, burst sizes, queue sizes and organizations, turnaround overhead, memory-controller page protocol, algorithms for assigning request priorities and scheduling requests dynamically, etc. In this design space, we see a wide variation in application execution times: for example, ...*

#### 14 Multimode scan: Test per clock BIST for IP cores

Adit D. Singh, Markus Seuring, Michael Gössel, Egor S. Sogomonyan

October 2003 **ACM Transactions on Design Automation of Electronic Systems (TODAES)**, Volume 8 Issue 4

Full text available:  [pdf\(168.82 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


Built-in self-test (BIST) is an attractive design-for-test methodology for core-based SoC design because of the minimal need for test access when tests are generated and evaluated within the core itself. However, the scan based logic BIST approach being widely considered for this application suffers from two significant weaknesses: slow test-per-scan execution, and a limited capability for detecting realistic timing and delay faults, critical in deep submicron technologies. The new multimode sca ...

**Keywords:** BIST, SoC, digital testing, scan

#### 15 Bibliography of recent publications on computer communication

Martha Steenstrup

January 1998 **ACM SIGCOMM Computer Communication Review**, Volume 28 Issue 1


Full text available:  [pdf\(2.02 MB\)](#) Additional Information: [full citation](#), [abstract](#), [index terms](#)

The quantitative results presented in our SIGCOMM '97 paper [1] include numerous minor errors. These errors were caused by programming bugs that led to faulty analyses and simulations, and by inaccurate transcriptions during the preparation of the paper. Here we present corrected figures and tables, as well as corrections to values that appeared in the text of the original paper. The effect of correcting the errors is to reduce the differences between the results based on the proxy trace and tho ...

#### 16 Complexity-effective superscalar processors

Subbarao Palacharla, Norman P. Jouppi, J. E. Smith

May 1997 **ACM SIGARCH Computer Architecture News , Proceedings of the 24th annual international symposium on Computer architecture**, Volume 25 Issue 2


Full text available:  [pdf\(2.21 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The performance tradeoff between hardware complexity and clock speed is studied. First, a generic superscalar pipeline is defined. Then the specific areas of register renaming, instruction window wakeup and selection logic, and operand bypassing are analyzed. Each is modeled and Spice simulated for feature sizes of 0.8 $\mu$ m, 0.35 $\mu$ m, and 0.18 $\mu$ m. Performance results and trends are expressed in terms of issue width and window size. Our analysis indicates that window wakeu ...

#### 17 The design of system architectures for information retrieval

L. A. Hollaar, B. J. Hurley, D. J. Kuck, D. H. Lawrie, J. W.S. Liu, J. M. Milner, J. K. Morgan, J. R. Rinewalt, W. H. Stelhorn

October 1976 **Proceedings of the annual conference**

Full text available:  [pdf\(638.08 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A broad-based program for studying hardware, software and human factors affecting information retrieval system performance is described. Using EUREKA, a minicomputer-based retrieval program, studies of user adaptation to an on-line system, search strategy development and use of special features are in progress. Performance comparisons are made between machine-assisted users and those using conventional printed materials. Concurrently, special-purpose retrieval hardware is being designed, an ...

18 Flexible collaboration transparency: supporting worker independence in replicated application-sharing systems

James Begole, Mary Beth Rosson, Clifford A. Shaffer

June 1999 **ACM Transactions on Computer-Human Interaction (TOCHI)**, Volume 6 Issue 2

Full text available:  [pdf\(312.22 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

This article presents a critique of conventional collaboration transparency systems, also called "application-sharing" systems, which provide the real-time shared use of legacy single-user applications. We find that conventional collaboration transparency systems are inefficient in their use of network resources and lack support for key groupware principles: concurrent work, relaxed WYSIWIS, and group awareness. Next, we present an alternative approach to implementing collaborat ...

**Keywords:** Flexible JAMM, Java, application sharing, collaboration transparency, computer-supported cooperative work, groupware, usability

19 Interconnect pipelining in a throughput-intensive FPGA architecture

Amit Singh, Arindam Mukherjee, Malgorzata Marek-Sadowska

February 2001 **Proceedings of the 2001 ACM/SIGDA ninth international symposium on Field programmable gate arrays**

Full text available:  [pdf\(203.52 KB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Wave-steering is a new design methodology that realizes high throughput circuits by embedding layout friendly synthesized structures in silicon. In the wave-steering design methodology, circuits inherently utilize latches. Inside the synthesized structures they are used for signal skewing, and on the interconnects to guarantee the correct arrival times at the inputs. Recently, we proposed a novel high-throughput FPGA architecture based on the wave-steering design principle to handle throu ...

20 On embedding a microarchitectural design language within Haskell

John Launchbury, Jeffrey R. Lewis, Byron Cook

September 1999 **ACM SIGPLAN Notices , Proceedings of the fourth ACM SIGPLAN international conference on Functional programming**, Volume 34 Issue 9

Full text available:  [pdf\(1.26 MB\)](#)

Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Based on our experience with modelling and verifying microarchitectural designs within Haskell, this paper examines our use of Haskell as host for an embedded language. In particular, we highlight our use of Haskell's lazy lists, type classes, lazy state monad, and unsafe Perform IO, and point to several areas where Haskell could be improved in the future. We end with an example of a benefit gained by bringing the functional perspective to microarchitectural modelling.

Results 1 - 20 of 200

Result page: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [next](#)

The ACM Portal is published by the Association for Computing Machinery. Copyright © 2004 ACM, Inc.

[Terms of Usage](#) [Privacy Policy](#) [Code of Ethics](#) [Contact Us](#)

Useful downloads:  [Adobe Acrobat](#)  [QuickTime](#)  [Windows Media Player](#)  [Real Player](#)